TRIP REDUCTION STUDY:

THE IMPACT OF TELECOMMUTING ON DELAY IN THE WASHINGTON, D.C. AREA

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1. Introduction

Traffic congestion is a major problem for the Washington, D.C. area. Travel estimates for 1990 indicate that the volume of traffic on the area's roadways was greater than the available highway capacity. Further, the region suffers from the second highest per capita delays in the nation and the annual cost per vehicle, accounting for both fuel and lost time, is the worst in the nation. Over the next few decades, delay will continue to be a problem as growth in the demand for travel is expected to continue outpacing new highway construction in the region. Current projections show that population will increase by 15% between now and 2010 and employment by 19% over the same time period (www.mwcog.org).

Managing this problem will likely require a variety of non-traditional strategies, such as encouraging the use of telecommuting and other flexible work arrangements in the workplace, using advanced technologies to manage and control traffic or to better inform travelers of traffic conditions, and implementing road pricing or HOT lanes in highly congested corridors. This study focuses on telecommuting, and the impact that an increase in this activity by employees in the Washington, D.C. area could have on overall delay and congestion in the region. The study is not intended to explore every aspect of this subject but rather to provide a rough estimate of the extent to which a reduction in trips arising from increased telecommuting could benefit the region. What this might feel like to commuters in the area is also considered using a typical Friday A.M. peak hour traffic as a point of reference.

2. Background on Telecommuting

2.1. What is Telecommuting?

Telecommuting is often viewed as a subset of teleworking[1]. Teleworking includes all work-related activities substituted by telecommunications and other advanced technologies for travel. So, whereas telecommuting is any such teleworking activity that reduces or eliminates an employee's commute, teleworking more broadly encompasses such things as teleconferencing or e-mail correspondence. Teleprocesses are an even more general category of activities that go beyond the workplace, and include for example, the use of the Internet for shopping, e-mail for social correspondence or distance learning (US DOT, 1993).

It is also important to recognize that telecommuting does not necessarily involve work at home, but it can also include the use of a Telework Center, located at some point between an individual's home and workplace. A Telework Center is a facility equipped with computers, phones, Internet and e-mail access, teleconferencing equipment and other hardware and software necessary for conducting business activities.

The potential benefits of telecommuting are numerous. Telecommuting can help employers to manage scarce office space, improve staff productivity, increase job satisfaction and employee morale. Transportation-related benefits have also been documented by the experiences of businesses and public agencies across the nation (Turnbull, 1997). Some of these benefits include (US DOT, 1993):

- Decreased commuting time, expenses and anxiety;
- Reduced energy use and air and noise pollution;
- Reduced frequency of traffic incidents;
- Enhanced mobility as a result of improved traffic conditions;
- Decreased highway maintenance and capital expenditures; and,
- Increased smoothing of traffic, particularly during peak hours of the day.

A handful of studies have attempted to quantify the transportation-related benefits of telecommuting. Boghani (1992) projects that a 10 to 20 percent reduction in travel resulting from the use of teleprocesses would result in time savings of 3.1 billion hours, and several 100 million dollars of infrastructure maintenance expenditures. The U.S. Department of Energy (1994) has estimated that a minimal increase in telecommuting will produce fairly sizeable energy cost savings in the neighborhood of $13 ot 20 billion within the next decade. Further, the U.S. DOT projected that over the last decade teleprocessing has saved hundreds of lives and prevented up to 120,000 of thousands of accidents[2].

2.2. Telecommuting in the U.S. versus Washington, D.C.

In 1992, it was estimated that as much as 30% of the U.S. workforce worked at home at least part of the time. Of these individuals, approximately (1.6%) or 2 million were telecommuters per se, while the remainder included the self-employed,

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[1] It is important to recognize that these terms – telecommuting and teleworking – are often used interchangeability.

[2] This study was done in 1993, so these numbers are based on projections made before the fact.

"moonlighters" and employees who take their work home with them. The study projected a doubling of the telecommuting by 1997 and a six-fold increase in the activity by 2002 (US DOT, 1993).

In the Washington, D.C. area, current estimates of telecommuting are fairly comparable to those projected for the entire U.S. in the US DOT study. According to a survey conducted by the Metropolitan Washington Council of Governments in September of 1996[3], approximately 6.8% of the region's workforce worked at home or at a local telework center during normal work hours at least occasionally and 2.6% teleworked two or more days per week. 92% of reported teleworkers worked at home while only 1% at a Telework Center. Roughly 73% claimed to use an automobile as their mode of transportation and 18% of those surveyed who don't currently telework expressed interest in this type of work arrangement(www.mwcog.org).

[3] Just over a one thousand telephone household surveys were completed, with a survey error rate of plus or minus 3.2 percent.
The survey area included the District of Columbia; Frederick County, Maryland; Montgomery County, Maryland; Prince George's County, Maryland; Calvert County, Maryland; Charles County, Maryland; Loudoun County, Virginia; Fairfax County, Virginia; Prince William County, Virginia; Stafford County, Virginia; and Arlington County, Virginia.

3. Telecommuting and Delay Reduction: Washington, D.C. Area

This study examines what impact additional telecommuting could have on transportation conditions in the region. Estimates of delay, vehicle hours traveled and vehicle miles traveled under different trip reduction scenarios were generated using the Metropolitan Washington Council of Governments regional transportation planning model (see technical appendix for a more thorough description of the model). The model was run with both 3% and 10% reductions in daily trips at each origin and destination in the region, excluding externally generated (i.e., through traffic) and heavy axle vehicle traffic. Trips were reduced proportionately across different areas of the region. Results of the trip reduction scenario simulations were subsequently compared with a baseline scenario for the year 1999 to estimate the incremental effect of trip reduction strategies on delay, vehicle hours traveled and vehicle miles traveled in the Washington, D.C. metropolitan area.

The model projects that a 3% reduction in total daily work-related trips (i.e., 3% reduction in vehicles on the road) will produce a:

- 2.4% reduction in daily vehicle miles traveled;
- 6.4% reduction in daily vehicle hours traveled (total travel time); and,
- 10.0% reduction in total daily delay[4].

For a 10% reduction in trips, the respective estimated impacts are 8.0%, 20.8%, and 30.0%. *These statistics suggest more generally that for every 1% reduction in trips, total travel time will decline by 2% and delay will decrease by over 3%*[5]. Reductions in vehicle miles traveled, vehicle hours traveled and warm-starts often associated with stop-and-go traffic conditions could also have a positive impact on the environment by lessening vehicular emissions.

What this might feel like to commuters in the Washington, D.C. metropolitan area is something similar to what they already experience during the Friday morning rush hour, although to a much greater extent. To many motorists, traffic often appears to be lighter on Friday than any other day of the work week, and in fact it is. *One estimate of this, the "Friday effect", is that A.M. peak hour traffic is 1.6% lighter on Friday than that on any other work day.* During the Friday morning rush hour, motorists experience, on average, travel times that are 2.43% and 4.42% lower than those experienced during other A.M. peak periods. *As a point of reference then, a 10% or even 3% reduction in daily trips traffic would produce traffic conditions that are much lighter than those that currently exist on a typical Friday morning.*

The travel times used in this study are those experienced on major highway segments in the region and reported every five minutes by *SmarTraveler* (www.smartraveler.com). *SmarTraveler* uses probe vehicles, video surveillance, and other techniques to estimate travel times. These times are reported for major highways

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[4] Delay is defined as the amount of time travelers spend stopped in traffic or traveling slower than expected, while vehicle hours traveled includes both delay and amount of time motorists spend traveling

[5] One should be careful though about extrapolating well beyond 10%, as the elasticities themselves were derived solely from scenarios assuming a 3 to 10% reduction in trips.

and arterials in the Washington, D.C. metropolitan area[6]. The finding that traffic is 1.6% lighter on Friday morning than other mornings of the work week was computed using the elasticities generated through the transportation planning model runs and the travel time estimates reported by *SmarTraveler*.

4. Conclusions and Recommendations

The results of this study provide what is believed to be a solid "mid-range" estimate of the impact that telecommuting could have on delay in the Washington, D.C. metropolitan area. One caution though is that the effects of latent demand were not considered explicitly in the analysis. Latent demand is an increase in traffic resulting from motorists taking advantage of improved conditions due to some demand substituting activity or capacity enhancement. Consequently, the positive impacts of telecommuting on delay might be slightly diminished by the increasing demand for travel. The negative effects of latent demand however can be greatly diminished through the implementation of Transportation Demand Management (TDM) measures, which are specifically aimed at keeping people off the road despite improving conditions.

The estimates provided in this study do not reflect the "high technology" culture of this region, which might enhance the positive impacts of telecommuting. The potential for telecommuting and e-commerce in this region is significant given its high technology industrial base. Jobs in this sector perform "knowledge functions", sales and marketing, all of which are activities conducive to teleworking. Another important factor not considered in the study is the reduction in delay that might result from peak spreading, or a redistribution of traffic during the day. This is one area in which the benefits of telecommuting could be quite significant.

Technical Appendix: Transportation Planning Model

The MWCOG transportation model is used to project the transportation-related impacts of planned road and transit improvements in the Washington, D.C. area. This area, includes the counties of Fairfax, Montgomery, Prince William, Prince Georges, part of Loudoun; the independent cities of Arlington, Alexandria, Fairfax City, Manassas Park, and Manassas, and the District of Columbia. There are 1478 transportation analysis zones (TAZs), 193 Transportation Analysis Districts (TADs), or aggregations of TAZs. It characterizes current and future traffic conditions (e.g., delay, vehicle hours traveled, and vehicle miles traveled) on all interstates, highways, and major arterials in the metropolitan area, and ridership on the METRO rail line.

This model is based on the traditional four-step modeling process, which captures each of the following in stages:

- *trip generation* or number of trips produced in and attracted to each zone in the transportation study area,
- *trip distribution* or number of trips going between each origin and destination, or each pair of zones in the study area,
- *mode choice* or travelers choice of mode (e.g., drive alone, car pool, transit), and,
- *traffic assignment* or travelers choice of routes between each origin and destination.

There are six different trip types or purposes in the model: work, shopping, other home-based trips, non-home-based trips, light and medium trucks, and heavy trucks. Each trip type has a different trip generation rate while trip distribution generates an origin-destination matrix where for each pair of zones, demand is a function of the travel impedance between zones, and the push and pull effects of each zone. Trips are assigned to the highway network using a "three-iteration, capacity restrained assignment" method. In the first iteration, the computer selects the shortest (in terms of travel time) route or path between each pair of zones, and based on these selections, loads one-fourth of all vehicles onto the network. Based on this assignment, travel speeds and times are updated, and used by the computer in the next iteration to select the shortest routes between each pair of zones. Subsequently, an additional one-fourth of all vehicles are loaded onto the network. This process is repeated for a third time, assigning the remaining vehicles to the network.

References

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